REMARKS

Based on the above amendments, claims 1-34 and 42-49 are pending, claims 45-49 being newly added. Claims 35-41 have been canceled as being directed to a non-elected invention. Applicants reserve the right to pursue a divisional application to the non-elected subject matter.

We note that in the Restriction Requirement dated September 25, 2007, dependent claim 43 was characterized as being directed to "a method of making a device." In fact, claim 43 depends from claim 42 and is clearly directed to a device corresponding to the elected Group. Accordingly, we respectfully request that claim 43 be examined.

Claim 1 has been amended to clarify that the semiconductor layer sequence is epitaxially formed and that the first current spreading layer and the second current spreading layer are non-epitaxially formed. Support for the amendment can be found, for example, in the Specification at page 5, lines 8-10 and page 12, lines 26-32.

Claim 25 has been amended to recite that "at least one of the first current spreading layer and the second current spreading layer is a contact surface."

New claims 45-49 are directed to embodiments of the elected group.

Support for the new claims 45-47 and 49 can be found, for example, in the Specification at page 3, lines 6-10 and page 6, lines 5-7.

New claim 48 explicitly clarifies the structure of the radiation-emitting semiconductor component at the first principal surface and at the second principal surface.

Claims 1, 3, 5-12, 17-18, 21, 25-26, 33 and 42 stand rejected under 35 U.S.C. §102(e) as being unpatentable over U.S. Patent 6,515,308 (Kneissl et al.).

Claims 2, 4, 13-16, 20, 22-24, 27-31, 34, 43 and 44 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kneissl et al. in combination with U.S. Patent 6,657,236 (Thibeault et al.), U.S. Patent application 2004/0120375 (Kwon), U.S. Patent 5,977,565 (Ishikawa), U.S. Patent 6,614,056 (Tarsa et al.), U.S. Patent 6,072,148 (Azdasht), U.S. Patent 6,573,537 (Steigerwald et al.), U.S. Patent application.2003/0136442 (Takamoto), and/or U.S. Patent application 2002/01311462 (Lin et al.).

In view of the amendment and the following remarks, Applicant respectfully requests reconsideration.

The radiation-emitting semiconductor component of amended claim 1 recites *inter alias* a semiconductor body that includes "an epitaxially formed semiconductor layer sequence with an electromagnetic radiation generating active zone, said epitaxially formed semiconductor layer sequence forming the semiconductor body," and "a first non-epitaxially formed current spreading layer", and "a second non-epitaxially formed current spreading layer disposed."

For radiation emitting semiconductor components, a semiconductor layer sequence with a high optical quality is important. The required optical quality can be achieved with, for example, an epitaxy process. Epitaxy is a growth process of a crystal on a crystalline substrate that determines their orientation. Specifically, in an epitaxially formed semiconductor layer sequence, the layers have the same layer structure and orientation. (*See*, *e.g.*, online Oxford English Dictionary, entry epitaxy: "**1960** *New Scientist* 25 Aug. 504/3 Epitaxial crystal growth (in which the growing crystal has the same orientation as the 'seed').")

Similarly, Wikipedia recites:

> Epitaxy is a kind of interface between a thin film and a substrate. The term epitaxy (Greek; epi "above" and taxis "in ordered manner") describes an ordered crystalline growth on a monocrystalline substrate.
>
> Epitaxial films may be grown from gaseous or liquid precursors. Because the substrate acts as a seed crystal, the deposited film takes on a lattice structure and orientation identical to those of the substrate. This is different from other thin-film deposition methods which deposit polycrystalline or amorphous films, even on single-crystal substrates.

In contrast, a non-eptiaxially formed current spreading layer does not have the same layer structure and orientation. Therefore, a lattice mismatch occurs between the epitaxially formed semiconductor layer sequence and the non-epitaxially formed current spreading layer(s). (For the term "lattice mismatch, *see*, *e.g.*, www.semiconductorglossary.com, entry lattice mismatch: "the situation where two materials featuring different lattice constants are brought together by

deposition of one material on top of another; in general, lattice mismatch will prevent growth of defect-free epitaxial film unless thickness of the film is below certain critical thickness; in this last case lattice mismatch is compensated by the strain in the film.")

Thus, a radiation-emitting semiconductor component with non-epitaxially formed current spreading layers on the principal surfaces of an epitaxially formed semiconductor layer sequence includes a lattice mismatch, e.g. an amorphous structure, at the interfaces.

It is noted that the materials for an epitaxy process are restricted to materials that allow lattice matching. For example, a metal oxide layer is usually not epitaxially grown on a III/V semiconductor.

The inventors realized that even though epitaxially formed layers have advantages in the semiconductor sequence, forming non-epitaxially current spreading layers on both principal surfaces of the epitaxially formed semiconductor layer sequence can have advantages. For example, the material restriction of an epitaxy process does not apply and more suited materials, e.g. metal oxides, can be used for electrically contacting the principal surfaces of the epitaxially formed semiconductor layer sequence. In addition, the epitaxially formed semiconductor layer sequence can be made thinner and therefore faster grown. Further advantages are disclosed, for example, in the Specification at page 5, lines 11-18.

Patentability of claim 1

In the Office action, Kneissl's layers 108 and 126 allegedly correspond to the first current spreading layer and the second current spreading layer, respectively. Applicant respectfully disagrees because the layer 108 is an epitaxially formed layer of Kneissl's VCSEL structure 100.

Kneissl discloses that the "nitride based semiconductor VCSEL structure 100" includes a substrate 102 "on which is epitaxially deposited a succession of semiconductor layers." Specifically, the VCSEL 100 of FIG. 1 includes the semiconductor layers 104-108, 114, 116-118, 120, and 126. (*See, e.g.*, column 4, lines 14-17 and FIG. 1.)

Kneissl explicitly discloses the layer 108 as a semiconductor layer, specifically as a III-V nitride layer. Thus, layer 108 is an epitaxially formed layer that is positioned between the distributed Bragg reflector 106 (including GaN and AlGaN layers) and the III-V nitride quantum well active region 114. Kneissl discloses the layer 108 to include, for example, n-type GaN:Si (i.e. Silicium doped gallium nitride), AlGaN:Si and InGaN:Si. (*See*, *e.g.*, column 4, lines 56-65.)

Kneissl discloses also layer 126 as a semiconductor layer, specifically as a III-V nitride layer. However, layer 126 is formed at the top of the epitaxially formed succession of semiconductor layers and could therefore also be formed of n-type ZnO, SnO_2 or InO_2. (*See*, *e.g.*, column 6, lines 20-24.)

Applicant notes that the later can be done because the generation of an upper distributed Bragg reflector 136 on top of layer 126 does not need to be part of the epitaxy process for VCSEL 100. As exemplary (non-epitaxially) methods for generating the upper distributed Bragg reflector 136, Kneissl e-beam evaporation, sputtering and chemical vapor deposition. (*See*, *e.g.*, column 6, lines 55-64.)

Thus, the III-V nitride layer 108 is part of the succession of semiconductor layers and can therefore not be understood as a non-epitaxially formed current spreading layer as recited in amended claim 1.

We note that the claimed limitations are not merely product-by-process limitations. To the contrary, the claimed non-epitaxially formed current spreading layers are structurally different from epitaxially formed current spreading layers at their interfaces with the epitaxially formed semiconductor body. For example, there will be a lattice mismatch at the interface between epitaxially and non-epitaxially formed layers, whereas there will be lattice matching between epitaxially formed layers. See, for example, new dependent claim 48, which explicitly describes this structural difference.

Moreover, Applicant could not find any disclosure that Kneissl would suggest to replace the epitaxially formed layer 108 with a non-epitaxially formed layer. Instead, a person of

ordinary skill in the art would know that such a replacement would split the VCSEL structure 100 into two separate semiconductor layer sequences. Accordinly, the lattice structure of the GaAs carrier 1 would affect the epitaxially grown layers 104 and 105 but it would not affect the semiconductor layers 114, 116-118, 120, and 126, which would contradict the concept of the epitaxially grown VCSEL structure 100.

At least for the foregoing reasons, amended claim 1 and its dependent claims should be allowed.

Patentability of claim 49

Claim 49 recites a radiation-emitting semiconductor component that includes *inter alias* a first non-epitaxially formed metal oxide current spreading layer and a second non-epitaxially formed metal oxide current spreading layer.

As explained above, Kneissl does not disclose nor suggest that the two layers 108 and 126 are "non-epitaxially formed current spreading layers." Specifically, Kneissl does not disclosed that layer 108 is a non-epitaxially metal oxide layer.

In view of the forgoing comments and the claim amendments, Applicant respectfully requests that the Examiner withdraw the rejections and that the application be allowed. To the extent the Examiner disagrees, Applicant invites the Examiner to contact the undersigned by telephone to discuss the case.

Conclusion

Any circumstance in which Applicant has: (a) addressed certain comments of the Examiner does not mean that Applicant concede other comments of the Examiner; (b) made arguments for the patentability of some claims does not mean that there are not other good reasons for patentability of those claims and other claims; or (c) amended or canceled a claim does not mean that Applicant concede any of the Examiner's positions with respect to that claim or other claims.

The fee for a Two-Month Extension of Time of $460.00 is being paid concurrently with the Electronic Filing System (EFS) by way of Deposit Account authorization. Please apply any other charges or credits to deposit account 06-1050, referencing 12406-147US1.

Respectfully submitted,

Date: 6/2/08

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